

RECEIVED
WATER PROGRAMS DIVISION

JAN 20 1976

EPA RS

OPERATIONS MANUAL

FOR

WASTE WATER SYSTEM

OF

HAMILTON TOWNSHIP

FRANKLIN COUNTY

PENNSYLVANIA

PREPARED BY:

ARROWOOD, INCORPORATED
CONSULTING ENGINEERS
CHAMBERSBURG, PENNA.

OPERATION
OF
WASTE WATER COLLECTION SYSTEM

1. GENERAL

- A. The regular maintenance of the waste water collection lines are a necessity in order to provide the service for which the lines are designed and to protect the taxpayer's investment. To provide the regular maintenance, a competent staff must be available and certain maintenance procedures must be followed.
- B. This Phase I system includes approximately 4900 feet of 8" and 10" gravity sewer collectors, 2155 feet of 12" interceptor sewers, and a metering station.

2. STAFF

A. Personnel

A minimum of two township employees shall be assigned to this work. A third man will be necessary when entry into a manhole is required. By assigning two men as the regular maintenance staff, the Township is guaranteeing that one trained man will always be available. The third man shall be available should an emergency occur or when entry into a manhole is required.

3. A. MAP

A map of the system as built is a part of this manual as EXHIBIT I. Any additions, alterations, laterals added, or other changes in the system shall be recorded in red on the plans.

B. LOG SHEET

A form of log sheet is included in EXHIBIT II. An entry shall be made when the lines are inspected with a specific notation of any unusual conditions found.

C. METER CHARTS

The charts from the metering station shall be filed in an assigned file in the Township offices. Copies of all information sent to the Borough of Chambersburg (metering station maintenance and inspection reports by Manufacturer's representatives) shall be placed in the same file.

D. OTHER RECORDS

A record shall be maintained of the persons to be notified in case of an

emergency with current telephone numbers. The usual order of notification in an emergency is as follows:

1. Police/Fire/Ambulance
2. Township Officials
3. Consulting Engineer

A space has been provided on the log sheet for these telephone numbers.

4. INSPECTION AND CLEANING

A. WHY

An inspection of the lines will reveal whether any debris and/or silt is accumulating in the lines which can cause stoppages. Often inflow/infiltration can be observed. Any unusual condition of the manholes shall be recorded.

B. WHEN

The lines shall be inspected every three months.

C. HOW

An inspection of a section of sewer lines shall commence at the upstream end by removing the manhole covers with the proper tool. Look for the following:

1. Accumulation of solids and debris on the manhole bottom above the manhole channel indicating a surcharged line.
2. Accumulation of silt in the manhole channels.
3. Condition of the manhole walls and steps.
4. Check manhole cover tightness to prevent noise caused by traffic and excessive infiltration.

D. WHAT TO DO

Any accumulation of silt, debris, and other solids shall be removed by either flushing or bailing. Any stones, bricks, wood or other material which can damage a pump shall be removed from the manhole immediately. The remaining silt can be flushed down the line with a fire hose. The defects in the manhole walls shall be repaired by patching with a mixture of cement, sand and epoxy. The same mixture can be used to repair loose manhole steps.

5. SAFETY

A. SAFETY FOR PERSONNEL

The men maintaining the system shall at all times practice safety rules which will protect them from injury and in compliance with OSHA Standards.

1. Personal Hygiene

- a. Personnel should be made aware of the fact that harmful micro-organisms are carried in waste water and these "germs" can cause serious infections and diseases. By using normal precautions and various safety devices, workmen can guard against these health hazards.
- b. The first preventive measure after making direct contact with contaminated objects is to wash hands before eating, smoking, or putting anything from hand to mouth. A germicidal soap is recommended. A stiff bristle brush should be used. If soap and water are not available, use waterless soap until soap and water are available.
- c. Reinforced rubber gloves should be worn when direct contact with contaminated objects is expected, such as, repairing sewer pipes, cleaning manholes, rodding equipment, and any tools. Gloves protect the hands from cuts, scratches, and lacerations which can become infected.
- d. Any open cut or sore is dangerous and shall be disinfected immediately. After first aid is applied, the wound shall be checked and given additional treatment needed by medical personnel.

B. MANHOLE WORK - GENERAL

Plan the work before leaving the shop so that proper tools and equipment, traffic warning devices, personal protective equipment, sufficient men, etc., will be available at the job location. Any shortage of necessary items may result in a job injury.

1. Traffic Warning Devices

Unpredictable driving is a hazard over which the crew has least control. Before opening the manhole, the traffic warning devices should be placed to provide an adequate work area around the manhole and, at the same time, to present the least impediment and hazard to traffic. If possible, place trucks or equipment between the work area and the traffic. Use rotating warning lights on all vehicles parked in the work area.

2. Test for Safe Atmosphere

The next step is to test the atmosphere within the manhole to make certain it is safe to enter. These tests are made with the explosimeter, and an oxygen deficiency indicator. Take a reading through a hole in the cover before it is removed. After removing cover, make further tests in the lower levels of the hole. Use the oxygen deficiency indicator to test for carbon monoxide and hydrogen sulfide gases, both of which are extremely fatal.

3. Ventilation

Whenever flammable gas or oxygen deficiency is discovered, forced ventilation must be used to provide a safe atmosphere within the manhole for the crew. After forced ventilation, retest the atmosphere. If a prolonged working period in the hole is required, recheck the atmosphere often for accumulation of harmful gases. Whenever flammable gas is found, the blower equipment should be placed upwind from the manhole to prevent the ignition of the gases by the blower equipment. Locate the equipment so that the exhaust fumes will not be introduced into the manhole.

4. Removal of Manhole Cover

Use the tool provided for this purpose. Insert the hook on the tool in the hole in the cover, grasp the handle with both hands and with a straight back, lift the cover by straightening the legs which have been slightly bent at the knees. Do not drop the cover on the toes. Do not use any short handled tools such as a screw driver, pick axe, or short bars. Many back injuries have resulted from removing covers with improper tools. Removed manhole covers should be placed a minimum of two (2) ft. from the opening and resting on a flat surface, not tilted.

5. Entering Manhole

No man shall enter a manhole unless there are two other men stationed at the surface. The man entering the manhole should wear safety harness to which a line is attached and attended constantly by one of the men on the surface. To enter the manhole, the man should sit on the surface facing the rungs with the feet in the hole and arms extended over the sides of the hole for support. Slide the body forward and downward until the feet rest on a rung. From this point on, it is easy to descend into the hole. If the manhole rungs are unsafe, use a portable ladder inserted into the hole. No man should descend into a manhole carrying tools or other gear in his hands. Use a large bucket with a hand line to lower items into the hole. The men in the hole should wear:

- a. Safety hat
- b. Coveralls
- c. Boots
- d. Gloves

Do not smoke while in a manhole.

On leaving a manhole, the outer garments should be removed and the hands washed in soap and hot water. Clean all tools and gear used in the hole.

6. TRENCH SHORING

Cave-ins can be prevented by the use of proper shoring. Shoring must be provided to meet the conditions encountered on each job. These conditions are:

- A. Soil Types - Trenches may be cut through filled ground or sand or sandy soil which will require solid sheeting and shoring, or, through rock which will require little or no shoring. Wet soil will require shoring.
- B. Ground Water and Weather - Any moisture added by rainfall, stream overflow, drainage or sewer overflow can cause the soils conditions to change requiring additional shoring. A frozen trench may be safe, but it will cave in after thawing.
- C. Static Loads on the Soils - Due to the heavy loads of buildings or other structures imposed on the soils, any excavations for trenches near the structures, may disturb the foundations. Heavy shoring will be required to protect the structures and the crew working in the trenches.
- D. Vibrations - Vibrations from traffic and other operating machinery can cause normally stable soil to cave-in. Heavy shoring will be required when vehicles or other machinery are operated near the trench.
- E. Protection of Shoring - Trenching machinery should be level at all times to prevent undercutting sides of trench. Also, this permits the buckets or hoists to be removed from the trench without damaging the shoring or bracing. Do not place any heavy equipment, such as pumps, or air compressors on shoring or cross bracing. Shoring should be placed as soon as the trench is opened.

7. METERING STATION AND PARSHALL FLUME

A.

1. General

The explosion proof metering transmitter and receiver were manufactured by Badger Meter Manufacturing Co., 4595 West Brown Deer Road, Milwaukee, Wisconsin, 53223. The shop drawings with the specifications for the recording equipment are attached as Appendix C. The receiver is Badger Style 2701E and the transmitter is Style ML-XP. Two (2) inch, three (3) inch, and six (6) inch Parshall flumes have been installed as metering elements with the six (6) inch flume blanked off until flows reach such a magnitude to require its use. At that future time the meter will have to be re-calibrated to compensate for the effect of the six (6) inch flume.

2. MAINTENANCE

- a. The Hamilton Township Municipal Authority has a contract with representatives of Badger Meter Mfg. Co., to check, recalibrate, and maintain this installation. The contract specifies a quarterly check of the station, and certification as to calibration and maintenance. This quarterly maintenance and certification is required by the treatment agreement between the Borough of Chambersburg and the Township Authority. In view of this legal requirement concerning the maintenance of the metering station, any malfunctions of the metering gear should be reported to the factory maintenance representatives:

William G. Malden, Inc.
215 Rech Avenue
Oreland, Pa. 19075
Telephone: 215-884-1026

3. CLEANING

The channel and Parshall flume should be relatively free of any accumulation of debris and solids in order for the transmitters to send the proper signal. This debris can be washed out with a hose. Care should be used to prevent the water pressure from damaging the float or any part of the metering gear in the water.

HAMILTON TOWNSHIP
FRANKLIN COUNTY, PENNSYLVANIA
INSPECTION LOG

Ambulance _____
Police/Fire _____
Township Supervisors _____
Engineer _____

[illegible]

DATA SHEET

USER (A) HAMILTON TOWNSHIP, OHIO
 ADDRESS CHAMBERSBURG PA.
 PURCHASER (B) PAUL K. DEARDORFF & SONS, INC.
 ADDRESS FAYETTEVILLE PA.
 CONS. ENG. (C) _____
 PURCHASE ORDER NO. DH-007-71 ISSUED BY (A) (B) (C) _____
 ORDER REP PDC 523 ORDER NO. _____

P-M SO 7-1-71 PAGE NO. 1 OF 1
 LEGEND FOR APPLICATION STRIPS, MULTI-PEN METERS
 RED _____
 GREEN _____
 PURPLE _____
 BLUE _____

INSTRUMENT
 1. METER SERIAL A-41356
 2. RECEIVER STYLE 2701E
 3. TRANSMITTER STYLE ML-XP ¹⁵⁰⁰⁰
 4. CURRENT 120 V, 60C ☒; 50C ☐; 25C ☐
 5. TRANS. TO REC. _____ FT. _____ GAUGE
 6. MAXIMUM DIFF. IN INCHES WATER
 _____ IN. WET ☐; DRY ☐
 7. MERCURY REQ. _____
 8. MERCURY BY: PENN ☐; CUSTOMER ☐
 9. CHART DRIVE: ELEC. ☒; SPRING ☐
 10. " REV.; 24 HR. ☒; 7 DAY ☐
 11. MAXIMUM METER CAPACITY
800 GPM
 12. MAX. FLOW _____
 13. AV. FLOW _____
 14. MIN. FLOW _____
 15. METER MOUNTING:
 WALL ☒; PANEL ☐; PIPE ☐
 OTHER _____
 16. AMBIENT TEMPERATURE RANGE
 TRANSMITTER _____ TO _____ F.
 RECEIVER _____ TO _____ F.
 17. CHART NO. 47578
 18. " UNITS GPM
 19. " MULT. DIRECT
 20. INDICATOR SCALE 0 TO 8 ³⁷³⁷²
 21. " UNITS GPM
 22. " MULT. 100
 23. TOTALIZER UNITS GALLONS
 24. " MULT. 1000
 25. GEAR TRAIN 38367-13 480 RPM
 26. ELECTRICAL { HIGH SET AT _____
 CONTACTS: { LOW SET AT _____
 27. TOTALIZER CONTACTS: NUMBER PER
 HOUR AT MAX. METER CAP. _____
 28. POTENTIOMETER _____ OHMS
 OPERATES _____
 29. VACUUM ☐; PNEUMATIC ☐
 TRANS. OPERATES _____
 AIR PRESS. RANGE _____
 30. CHECK ROD ☒
 31. AIR FLOW DIFFERENTIAL PRESSURE
 0 TO _____ IN. WATER
 32. INTERNAL ILLUM. ☐
 33. DOOR LOCK ☐
 34. 400 CHARTS NO. 47578
 35. 2 INSTRUCTION BOOKS

FLUID
 36. FLUID IS WATER
LIQUID
 37. OPER. PRESS. _____ PSIG
 38. TEMP. OPER. _____ °F. BASE _____ °F.
 39. SP. GR. OPER. _____ BASE _____
 OR DENSITY _____ #/CU. FT.
 40. VISCOSITY @ OPER. TEMP. _____ CPS.
STEAM
 41. OPER. PRESS. _____ PSIG
 42. OPER. TEMP. _____ °F.
 OR MOISTURE _____ %
GAS
 43. OPER. PRESS. _____ PSIG. TEMP. _____ °F.
 44. BASE PRESS. _____ PSIA. TEMP. _____ °F.
 45. LOCAL BAROMETER _____
 46. OPER. VISCOSITY _____ CPS.
 47. SP. GR. _____ OR MOL. WT. _____
 48. MOISTURE _____ % CP/CV _____
 49. CRITICAL PRESS. _____ PSIA*
 50. CRITICAL TEMP. _____ °F*
 *Required on gas mixtures or unusual gases.

FURNISH ACCESSORIES
 51. PAIR RESERVOIRS NO. _____
 52. PR. ORIF. FL. UNIONS _____
 53. ORIFICE VALVE SET NO. _____
 54. METER VALVE SET NO. _____
 55. CONNECTION SET NO. _____
 56. STRAIGHTENING VANE _____
 #53327-001 OUTDOOR CASE
 PAUL K. DEARDORFF & SONS INC.
 JAN-7-1972

PRIMARY ELEMENT
 *57. KIND 2" x 3" MARSHALL FLUME
 58. STYLE FLBGLS
 59. MATERIAL-BODY _____
 THRT. _____ FLG. _____
 60. DWG. _____
 61. CAT. NO. _____
PIPE LINE
 62. NOMINAL SIZE _____ IN.
 63. MEASURED I.D. _____ IN.
 64. SCHEDULE _____
 65. FLANGE TYPE _____
 66. " RATING _____ LB.
 67. FLOW IS: UP ☐; DN. ☐; HORIZ ☐
 68. UP STREAM STRAIGHT RUN _____
 _____ FOLLOWS _____
 69. DOWN STREAM STRAIGHT RUN _____
 70. PRESSURE TAPS: FLANGE ☐; VENA ☐
 71. TAP DIST. C.I. TO UP STREAM FACE
 UP _____ IN., DN _____ IN.
 72. TAP SIZE: UP _____ IN.; DN _____ IN.

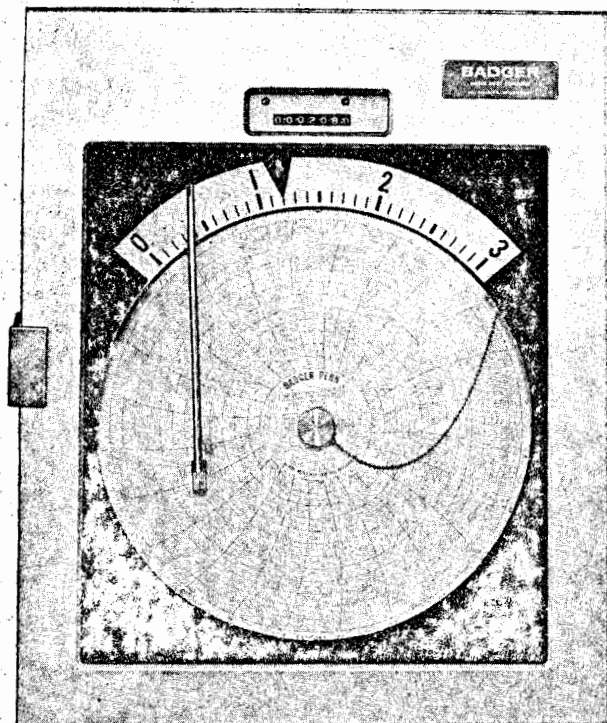
DRAWINGS:
 RECEIVER _____
 TRANSMITTER _____
 WIRING _____
 PIPING _____
 PRIMARY 5-320-3
 ACCESSORIES _____

42" FLUME BY OTHERS
HQ CURVE FOR 2" x 3"
FLUME COMBINATION
SK 4159
 OK Ray Poyantko
 Representative or Customer Signature
 DATE 12-10-71

APPROVED FOR CONSTRUCTION
[Signature]
 Date FEB 28 1972

BADGER METER MFG. COMPANY

2700 SERIES ELECTRONIC RECEIVER



The 2700 series electronic receiver is the product of 50 years' experience in the field of instrumentation. It can be used with a variety of transmitters for the measurement of flow, level, pressure, or temperature.

This Badger Meter metering system employs a null-balance inductance bridge (similar to a Wheatstone bridge) for fast, accurate readings. Essentially, the receiver consists of (1) an electronic amplifier, (2) a two-phase servo motor, (3) gear train with cam and follower, and (4) an inductance core and coil identical to that in the transmitter.

APPROVED FOR CONSTRUCTION

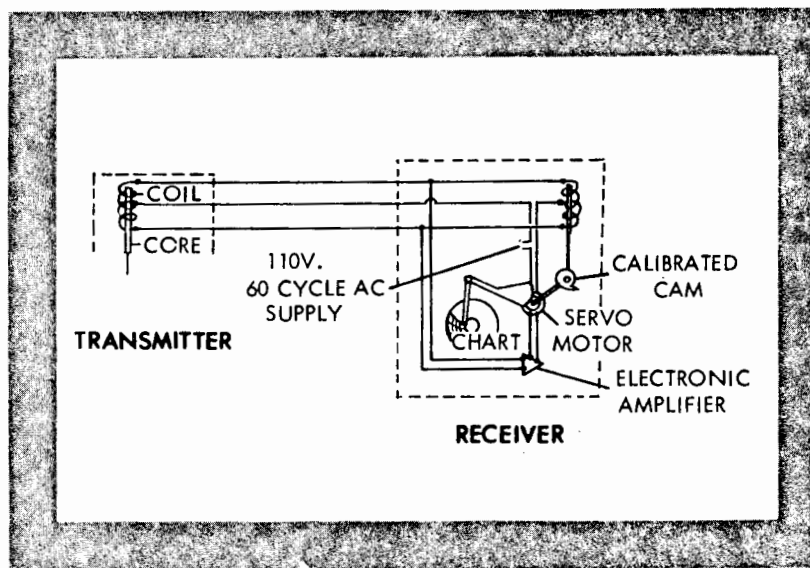
By [Signature]

Date FEB 28 1972

OPERATING PRINCIPLE

The receiver is connected to the transmitter by three transmission lines, and power (110V, 60C) is applied only to the receiver. Any movement of the transmitting core within its coil unbalances the electrical bridge and produces an actuating signal or error voltage. This signal is magnified by the amplifier to drive the two-phase, reversible servo motor which runs at a speed proportional to the error signal and in a direction established by the phase.

Rotation of the motor repositions the core in the receiving coil and reduces the error signal to zero. As a result, the electrical bridge is restored to a null-balance condition. Wear on receiver parts is substantially reduced because motion takes place only when changes occur in the measured variable. Furthermore, there is no time delay for recycling. The pen, indicator pointer, and totalizer mechanisms are positioned simultaneously when the system is in balance.



SIMPLIFIED CIRCUIT DIAGRAM

BADGER METER, INC.

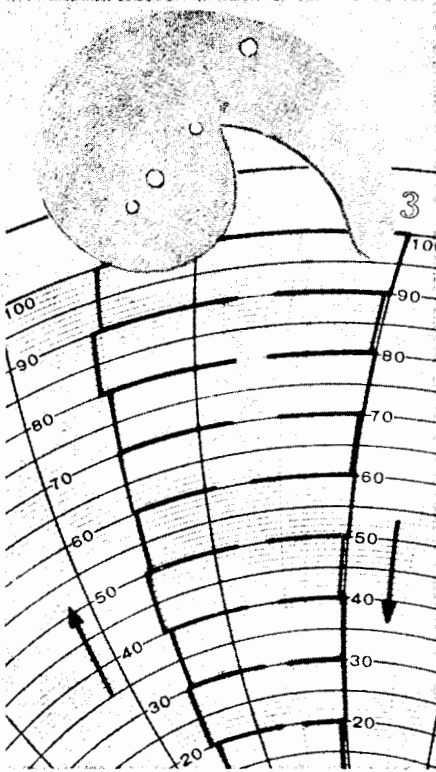
INSTRUMENTS DIVISION

4545 WEST BROWN DEER ROAD,
MILWAUKEE, WISCONSIN 53223

PRODUCT FEATURES

CALIBRATED ACCURACY

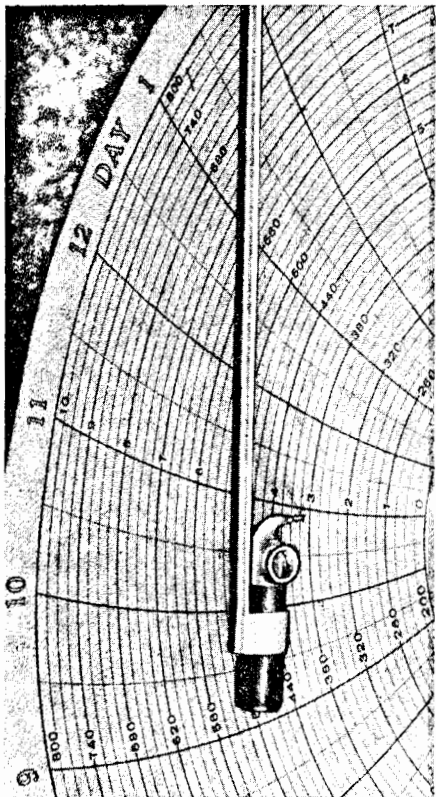
Each 2700 series instrument has a custom-designed cam which is contoured on the basis of a precise calibrating procedure for overall accuracy. A minimum of 11 cardinal values are applied during calibration — both ascending and descending the scale. The final calibration record shows perfect agreement between upscale and downscale readings as visual proof of no friction or hysteresis in the instruments.



CALIBRATED ACCURACY

RANGE OF CALIBRATION

The range to which instruments are calibrated depends on proper selection of the transmitter. Average error does not exceed plus or minus 1% of the actual value being measured over the range specified for the transmitter.



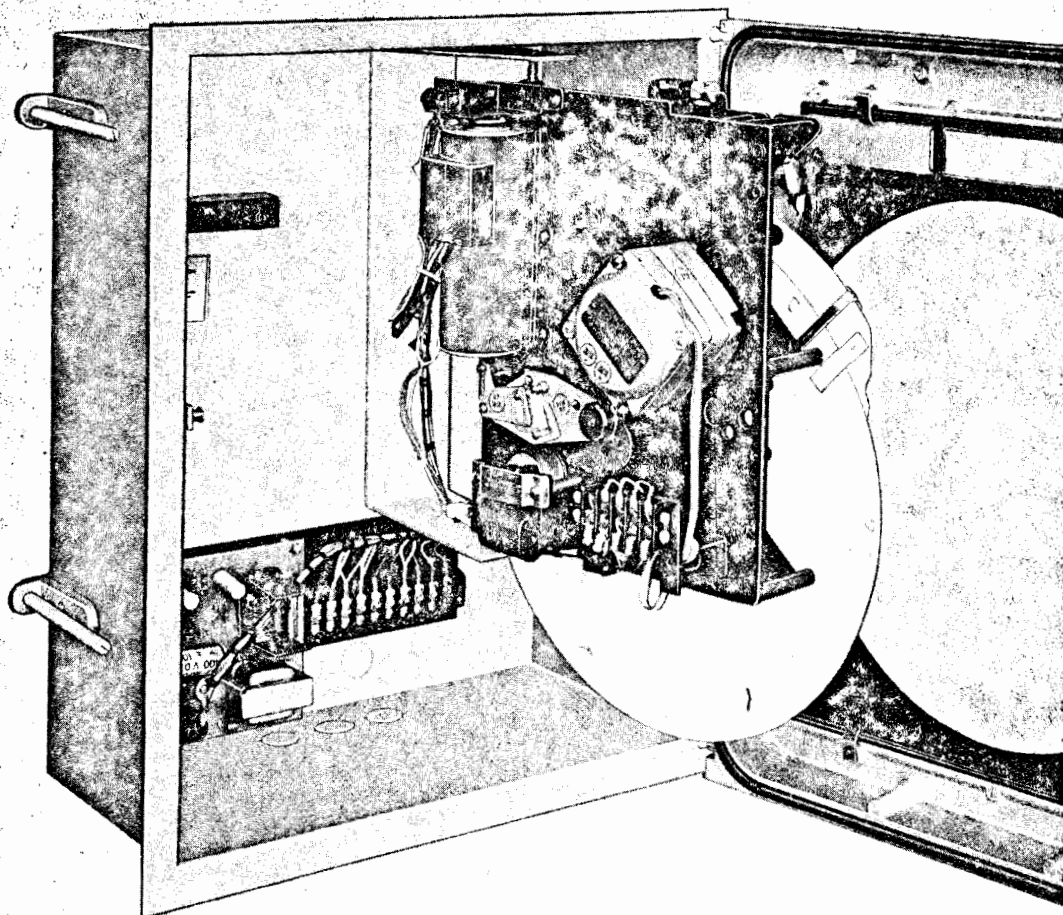
RESERVOIR GLASS PEN

RESERVOIR GLASS PEN

The extra-large reservoir, under normal use, has a one-month ink supply. The platinum iridium pen point traces a thin, legible chart record and requires no maintenance. Proper pen position produces a non-blotting record because the rugged pen arm is securely supported on pivots, thus assuring proper contact by gravity. Capillary pens also are available.

CHARTS

Clear, accurate readings are achieved at low scale, as well as high scale, through the use of evenly-graduated divisions over the entire range. Charts are made of specially-sized, non-absorbent, non-shrink paper and are printed in a humidity-controlled atmosphere with plates made on a highly-accurate engraving machine. The plates and hole-punching dies are integrally mounted on metal bases to assure concentricity and uniformity of the charts. A selection of 12-inch-diameter charts, with either 24-hour or 7-day rotation, can be made from more than 500 standards available.



**SWING-OUT FRAME PROVIDES
EASY ACCESS TO PARTS**

ACCESS TO PARTS

Easy access is provided to all component parts by mounting the receiver mechanism so the die-cast frame can be swung out for inspection without taking the instrument out of service. (See photo above).

BALANCING MOTOR

A powerful, oil-sealed motor provides maintenance-free operation. Accessory equipment such as switches, controls, and retransmitting devices can be used without sacrificing accuracy or repeatability of normal instrument functions. Response time from zero to full scale is approximately 8 seconds.

ELECTRONIC AMPLIFIER

To facilitate servicing, the 2700 series receivers utilize interchangeable, plug-in amplifiers with printed circuit design. High-rated components provide ample margin for safety.

COIL

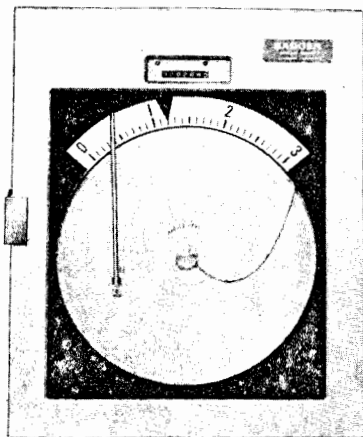
An epoxy resin, encapsulated coil with integrally-molded leads is used in the 2700 series receiver. The coil is not affected by moisture and provides above-average stability under wide temperature variations.

LOCATION

For convenience of the operator, the receiver can be located up to 5,000 feet away from the transmitter without impairing calibrated accuracy or speed of response.

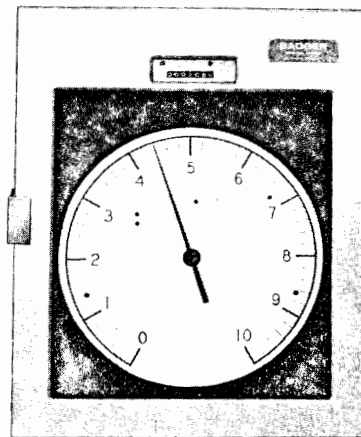
MAINTENANCE

With the null-balance system, wear in the receiver is held to a minimum because measurement sensing components are only in motion when changes occur in the measured variable. Self-lubricating graphite bushings and the oil-sealed balancing motor also reduce maintenance problems and eliminate the need for lubrication.



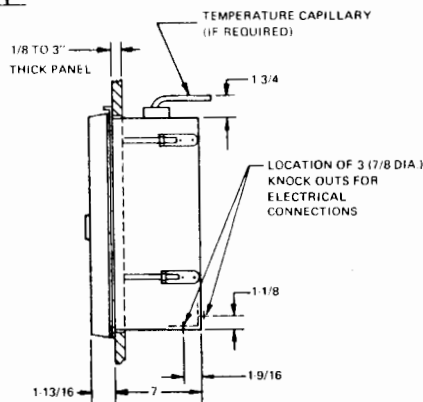
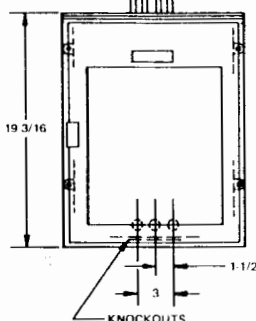
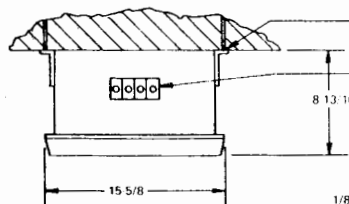
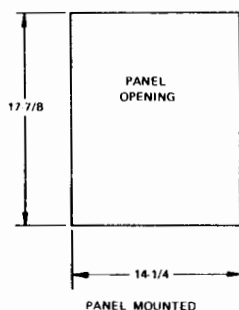
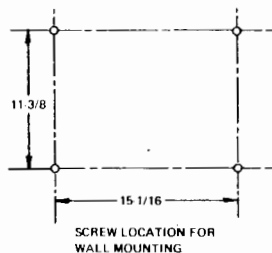
**RECEIVER
STYLE 2701**

This receiver serves the combined functions of a recording, indicating, and totalizing instrument. The large indicator pointer, operating over a 10-inch scale, provides excellent readability at a distance. The 12-inch linear chart used for recording purposes is full exposed to view so that the complete record can be quickly scanned. Total flow reading is accomplished by means of a seven-digit totalizer which is driven by a separate synchronous motor.



**RECEIVER
STYLE 2705**

Used as a remote indicator, this instrument is furnished with a 12-inch-diameter dial on a 300-degree scale to assure easy readability. The positioning mechanism can be actuated directly from a transmitter or by retransmission via a two-wire conductor from a potentiometer in the original instrument. Available with or without flow integrator. Style X701 and style X705 receivers both have pressed steel cases and aluminum doors.



**STANDARD
MOUNTING
DIMENSIONS**

Receiver case is adaptable to either wall or panel mounting.

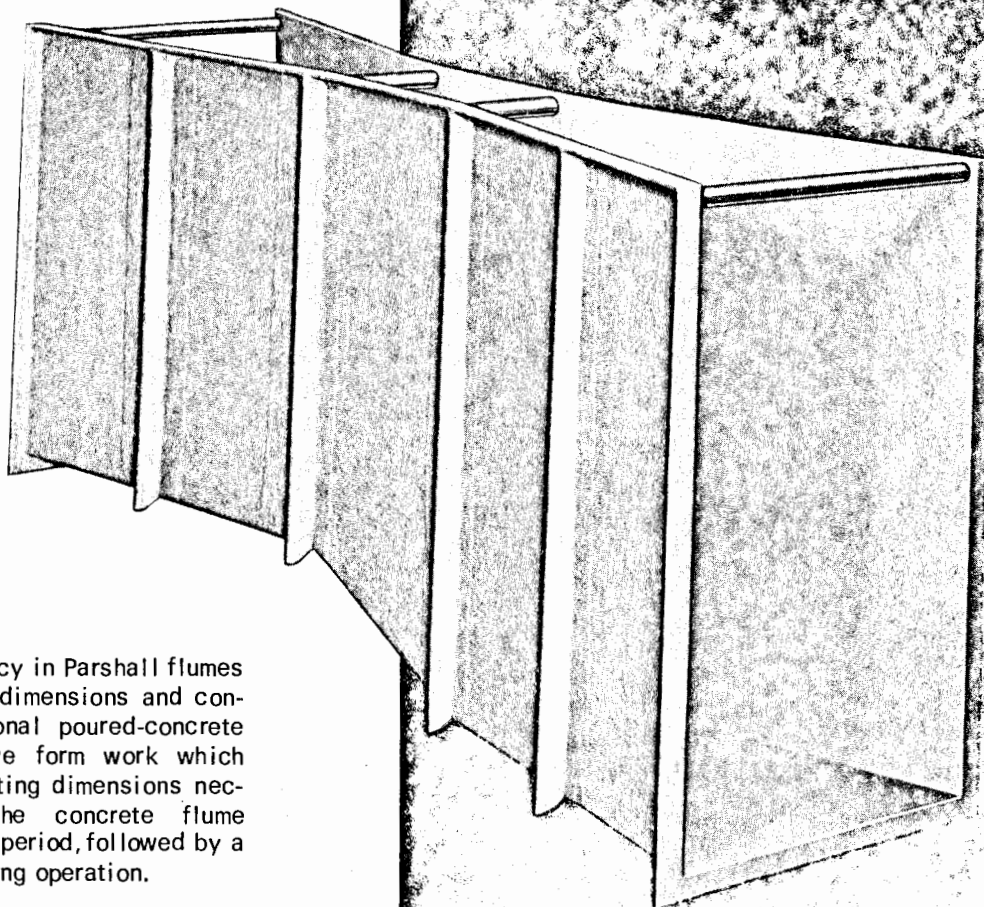
Badger warrants its meters and accessories to be free from defects in material and workmanship for a period of 18 months from date of shipment or 12 months from date of installation, whichever period shall be shorter. Any Badger meter or part found to be defective in Badger's judgment within such period will, at Badger's option, be repaired or replaced, without charge, or the purchase price thereof will be refunded, upon return thereof to factory or service center designated by Badger, transportation charges prepaid.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES WHATSOEVER INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Badger shall not be liable for any defects attributable to acts or omissions of others after shipment, nor any consequential, incidental or contingent damage whatsoever.

BADGER METER

MPF-4600
(Replaces P-406)

PARSHALL FLUMES



Flow measurement accuracy in Parshall flumes is dependent on precise dimensions and construction. The conventional poured-concrete flume requires expensive form work which rarely produces the exacting dimensions necessary. Furthermore, the concrete flume requires a lengthy curing period, followed by a final cleanup and smoothing operation.

Badger Meter preformed Parshall flumes, in addition to eliminating these uncertainties and economic disadvantages, also offer the additional advantages listed below.

ADVANTAGES

- 1. Accuracy:** Expert engineering and manufacturing techniques are used in initial design and construction to assure maximum accuracy. Badger Meter provides undivided responsibility for overall metering accuracy by offering the ML transmitter-recorder system for use with its Parshall flumes.
- 2. Installation:** Utmost simplicity. The preformed integral unit is placed in position, leveled and grouted. End flanges and reinforcing ribs provide

secure permanent anchorage in the concrete channel without the use of additional anchor clips.

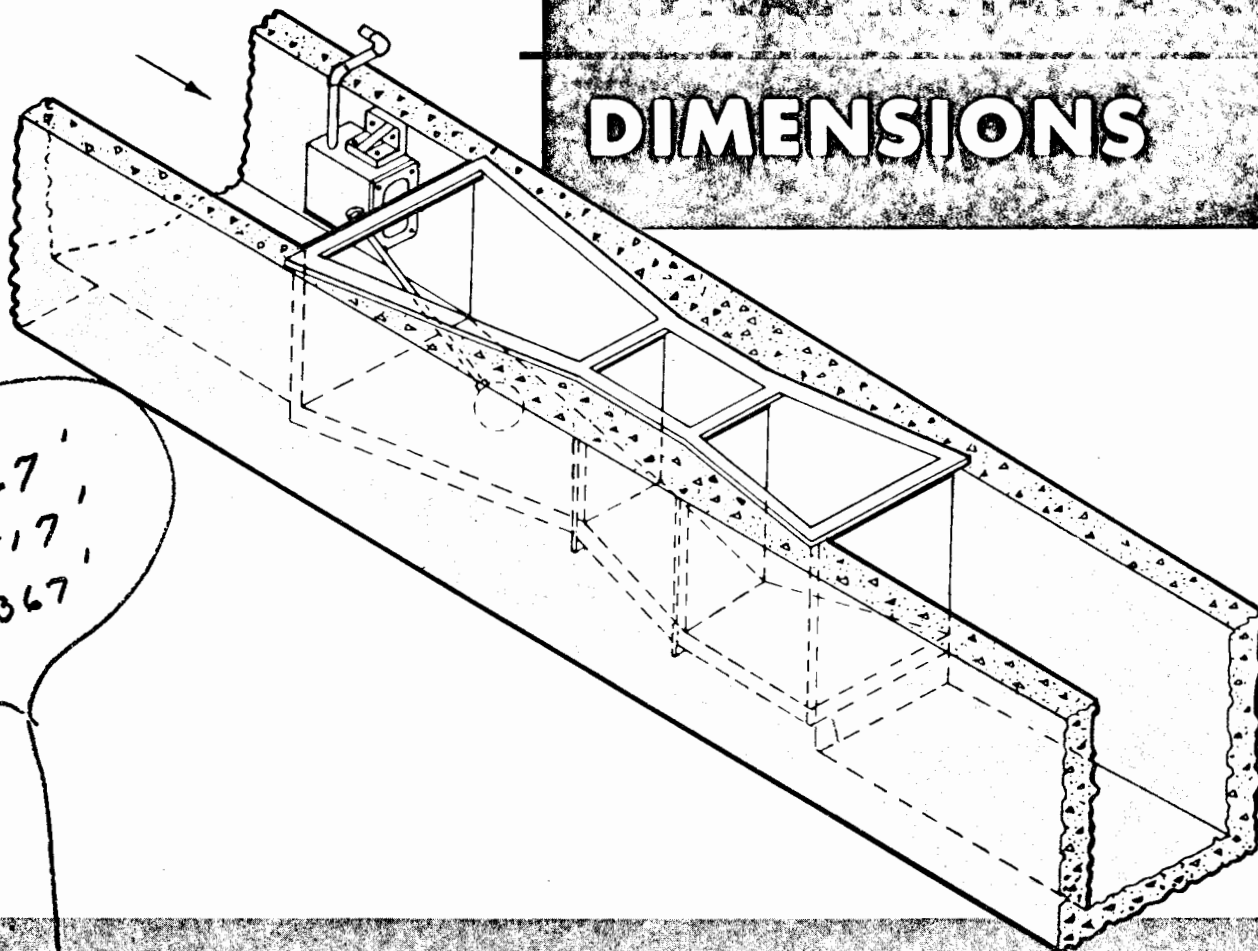
- 3. Materials:** Available in polyester reinforced with fibreglass, close-grained cast iron, or any sheet metal.
- 4. Ready To Use:** One-piece unit is completely finished. No smoothing, painting or coating required in the field.

BADGER METER CO.

INSTRUMENTS DIVISION

1540 W. Brown Deer Road, Milwaukee, Wisconsin 53229

DIMENSIONS



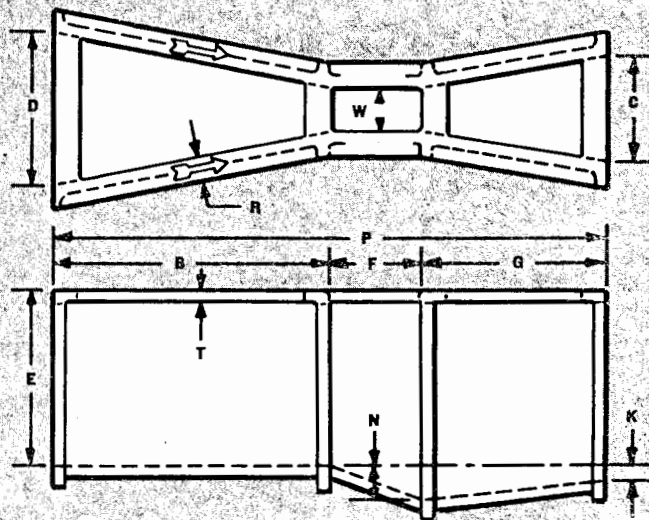
PARSHALL FLUME DIMENSIONS - INCHES

W	B	C	D	E	F	G	K	N	P	T		R		Weight		Tol- erance W
										Cast	Plas- tic	Cast	Plas- tic	Cast	Plas- tic	
3	18	7	10 $\frac{1}{8}$	24	6	12	1	2 $\frac{1}{4}$	36	$\frac{3}{4}$	$\frac{3}{4}$	1 $\frac{5}{8}$	$\frac{3}{4}$	465	85	$\frac{1}{4}$
6	24	15 $\frac{1}{2}$	15 $\frac{3}{8}$	24	12	24	3	4 $\frac{1}{2}$	60	$\frac{3}{4}$	$\frac{1}{4}$	1 $\frac{5}{8}$	1	700	110	$\frac{1}{2}$
9	34	15	22 $\frac{3}{8}$	30	12	18	3	4 $\frac{1}{2}$	64	$\frac{3}{4}$	$\frac{1}{4}$	1 $\frac{5}{8}$	1	1150	175	$\frac{1}{16}$
12	53	24	33 $\frac{3}{4}$	36	24	36	3	9	113	1	$\frac{3}{8}$	2	2 $\frac{1}{2}$	3920	270	$\frac{1}{16}$
18	56	30	40 $\frac{3}{8}$	36	24	36	3	9	116	1	$\frac{1}{2}$	2	2 $\frac{1}{2}$	4060	480	$\frac{1}{16}$
24	59	36	47 $\frac{1}{2}$	36	24	36	3	9	119	1	$\frac{1}{2}$	2	2 $\frac{1}{2}$	4800	690	$\frac{3}{32}$
36	64 $\frac{3}{4}$	48	61 $\frac{1}{8}$	36	24	36	3	9	124 $\frac{1}{4}$	†	$\frac{1}{2}$	†	2 $\frac{1}{2}$	†	800	$\frac{1}{8}$

Consult factory.

*Other than standard depths available for special requirements.

Correctly located (NPT) telltale pipe connections can be provided for either righthand or lefthand when required for float well operation.



WARRANTY

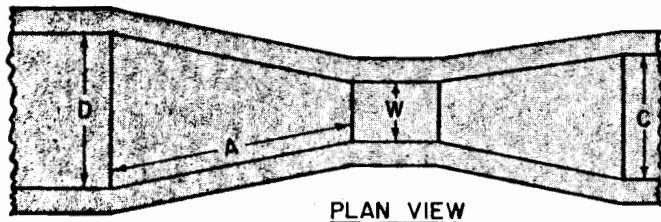
Badger warrants its meters and accessories to be free from defects in material and workmanship for a period of 18 months from date of shipment or 12 months from date of installation, whichever period shall be shorter. Any Badger meter or part found to be defective in Badger's judgment within such period will, at Badger's option, be repaired or replaced, without charge, or the purchase price thereof will be refunded, upon return thereof to factory or service center designated by Badger, transportation charges prepaid.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES WHATSOEVER INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Badger shall not be liable for any defects attributable to acts or omissions of others after shipment, nor any consequential, incidental or contingent damage whatsoever.

ML TRANSMITTER FOR P

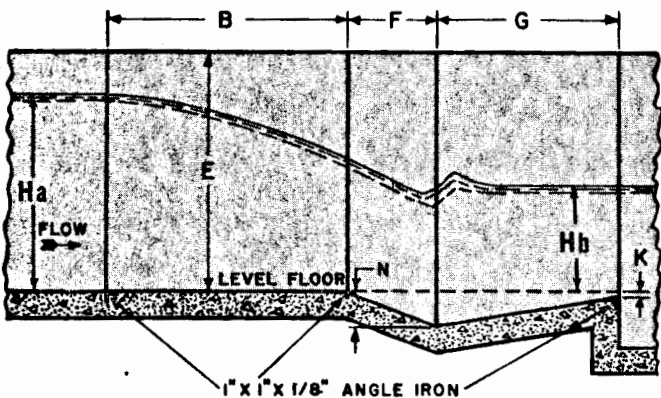
The Parshall flume is primarily intended to operate under conditions where velocities are moderate. It should be located beyond the influence of control structures, bends in canal alignment or other devices which cause eddies, waves or uneven flow. Conformance to these requisites will assure accuracy of the head versus flow curve as established by R. L. Parshall.

Since it is self-cleaning, the Parshall flume is recommended where sand, grit or other heavy solids are present in the flow stream. It also operates with a small loss of head or channel grade, about one-fourth that of weirs.



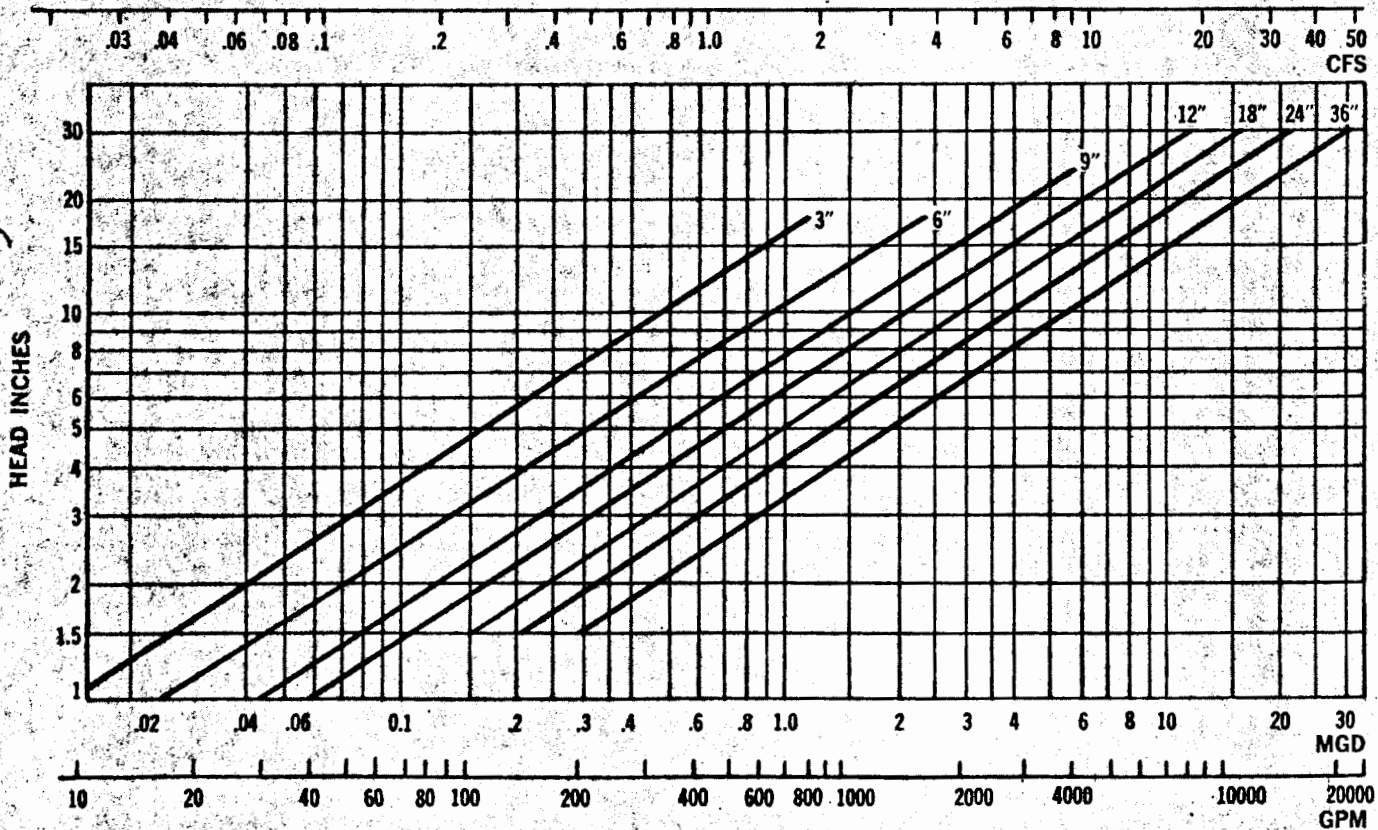
PARSHALL FLUME DIMENSIONS—INCHES

W	A	B	C	D	E	F	G	K	N
3	18.38	18.0	7	10.19	24.0	6.0	12.0	1.0	2.25
6	24.44	24.0	15.5	15.63	24.0	12.0	24.0	3.0	4.50
9	34.63	34.0	15.0	22.63	30.0	12.0	18.0	3.0	4.50
12	54.0	52.88	24.0	33.25	36.0	24.0	36.0	3.0	9.0
18	57.0	55.88	30.0	40.38	36.0	24.0	36.0	3.0	9.0
24	60.0	58.88	36.0	47.50	36.0	24.0	36.0	3.0	9.0
36	66.0	64.75	48.0	61.88	36.0	24.0	36.0	3.0	9.0
48	72.0	70.63	60.0	76.25	36.0	24.0	36.0	3.0	9.0
60	78.0	76.50	72.0	90.63	36.0	24.0	36.0	3.0	9.0
72	84.0	82.38	84.0	105.0	36.0	24.0	36.0	3.0	9.0
84	90.0	88.25	96.0	119.38	36.0	24.0	36.0	3.0	9.0
96	96.0	94.13	108.0	133.75	36.0	24.0	36.0	3.0	9.0



For single point measurement, the designed hydraulic gradient must be such that free flow exists at all flow rates. The gradient downstream of the flume must not rise above H_b value, preferably it should be below. H_b maximum must not exceed 60% of H_a for 3, 6 and 9" throat units; 70% for throat widths above 9".

PARSHALL FLUME CAPACITIES



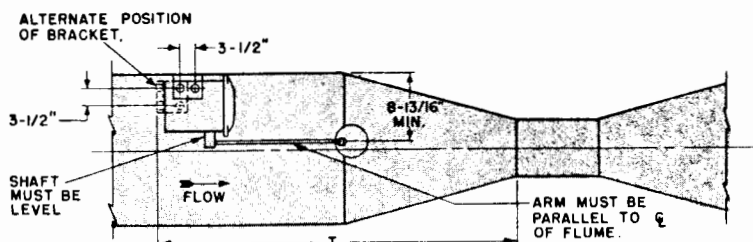
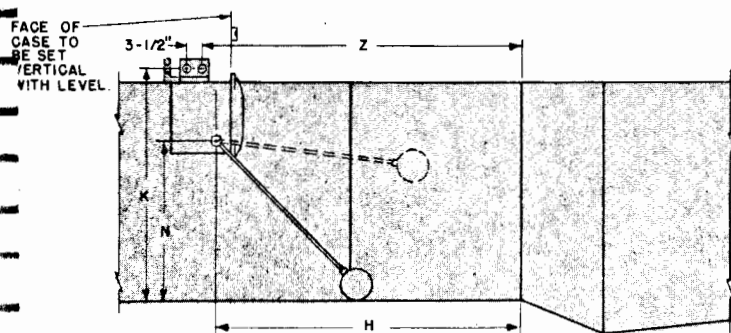
PARSHALL FLUMES

Bulletin P-406 describes the prefabricated Parshall flumes which Badger Meter, Inc. can supply with ML transmitters as a complete package under single-source responsibility. Costly concrete forms, dimensional errors and final cleanup are avoided by using these prefabricated flumes. Construction can be of cast iron, fiberglass, sheet metal, or other materials.

PARSHALL FLUME CAPACITIES AND TRANSMITTER MOUNTING DIMENSIONS.

	FLOW GPM	K	N	H	Z	T	FLOW MGD	K	N	H	Z	T
3"	150	18.24	7.93	20.07	21.76	27.70	0.2	17.90	7.59	19.61	21.30	27.23
	250	20.88	10.57	23.67	25.36	31.30	0.4	21.53	11.21	24.55	26.24	32.18
	400	24.22	13.90	28.22	29.91	35.85	0.6	24.56	14.24	28.69	30.37	36.31
	600	27.93	17.63	33.30	34.99	40.93	0.8	27.17	16.86	32.26	33.94	39.88
	800	31.34	21.03	37.95	39.63	45.57	1.0	29.63	19.31	35.60	37.29	43.23
6"	250	17.44	7.12	22.95	24.64	30.57	0.40	17.86	7.55	23.52	25.21	31.15
	500	20.73	10.42	27.45	29.13	35.07	0.70	20.56	10.25	27.21	28.90	34.84
	700	22.91	12.60	30.42	32.11	38.05	1.00	22.83	12.52	30.31	32.00	37.94
	900	24.87	14.56	33.10	34.79	40.72	1.25	24.58	14.27	32.70	34.38	40.32
	1600	30.73	20.42	41.09	42.78	48.72	2.40	31.23	20.92	41.77	43.46	49.40
9"	500	18.52	8.20	31.11	32.79	38.73	0.70	18.38	8.07	30.92	32.61	38.54
	1000	22.56	12.25	36.62	38.31	44.25	1.50	22.83	12.52	36.99	38.68	44.62
	2000	28.83	18.52	45.18	46.87	52.81	3.00	29.30	18.99	45.82	47.51	53.44
	3000	34.03	23.72	52.27	53.96	59.90	4.00	32.96	22.64	50.81	52.50	58.43
	4000	38.70	28.39	58.65	60.34	66.27	5.00	36.33	26.01	55.41	57.10	63.03
12"	500	17.33	7.02	42.12	43.80	49.74	0.75	17.49	7.18	42.33	44.02	49.96
	1500	23.12	12.80	50.01	51.69	57.63	1.80	22.24	11.93	48.81	50.50	56.44
	3000	30.55	20.24	60.15	61.84	67.78	4.40	30.78	20.47	60.46	62.15	68.09
	5000	38.08	27.77	70.43	72.12	78.05	7.50	38.81	28.50	71.43	73.11	79.05
	7000	44.65	34.34	79.39	81.08	87.02	10.00	44.48	34.17	79.16	80.85	86.79
18"	700	17.15	6.84	43.83	45.52	51.46	1.00	17.13	6.82	43.80	45.49	51.43
	2000	22.73	12.42	51.44	53.13	59.07	3.00	23.04	12.72	51.86	53.55	59.49
	5000	31.81	21.49	63.83	65.52	71.45	7.00	31.44	21.13	63.33	65.02	70.96
	8000	39.09	28.78	73.77	75.46	81.40	12.00	39.83	29.51	74.77	76.46	82.40
	11000	45.34	35.02	82.29	83.98	89.92	16.00	45.55	35.24	82.58	84.27	90.21
24"	2000	20.82	10.51	50.80	52.49	58.43	3.00	21.06	10.75	51.13	52.82	58.75
	4000	26.06	15.75	57.95	59.64	65.58	6.00	26.46	16.15	58.49	60.18	66.12
	8000	34.25	23.94	69.13	70.82	76.75	12.00	34.87	24.56	69.98	71.66	77.60
	12000	41.06	30.75	78.42	80.11	86.04	17.00	40.72	30.41	77.96	79.65	85.58
	15000	45.57	35.26	84.58	86.26	92.20	21.00	44.98	34.67	83.76	85.45	91.39
36"	3000	20.87	10.56	54.79	56.48	62.41	4.00	20.43	10.11	54.18	55.87	61.81
	6000	26.06	15.75	61.87	63.56	69.50	9.00	26.45	16.13	62.40	64.09	70.02
	10000	31.64	21.33	69.49	71.17	77.11	14.00	31.32	21.01	69.05	70.74	76.67
	15000	37.65	27.34	77.69	79.38	85.32	20.00	36.39	26.08	75.97	77.66	83.60
	20000	42.81	32.50	84.73	86.42	92.36	30.00	43.68	33.36	85.91	87.60	93.53

The maximum capacities shown are based on standard, immediately available charts.
For intermediate and lower capacities, contact Badger Meter, Inc., Instruments Division.



S-103
DRAWING NO.

2
REV.

UNLESS OTHERWISE SPECIFIED

TOLERANCE ON ANGULAR DIMENSIONS $\pm 0^{\circ} 30$ MIN.
REMOVE ALL BURRS .005 R. MAX. OR .005 MAX. X 45° CHFR.

TOLERANCE ON THREE PLACE DECIMAL DIMENSIONS $\pm .005$
TOLERANCE ON TWO PLACE DECIMAL DIMENSIONS $\pm .010$

MICRO-FINISH

ALL PROPRIETARY RIGHTS IN THE
SUBJECT MATTER SHOWN ON THIS
DRAWING ARE EXCLUSIVE PROPERTY
OF THE BADGER METER MFG. COMPANY.

Z-7768

1/4" BOLTS-4 REQUIRED
ANCHORS BY OTHERS

1-1/16" REF.

ALTERNATE POSTION
OF CONDUIT

11-1/2"

2-3/16"

6.75

5" DIA.
4 HOLES

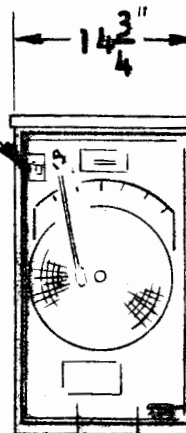
21.56

WALL MOUNTING
HOLES LOCATIONS

THERMOSTAT

2'

4-1/2' - 5'
RECOMMENDED



DOOR SEAL GASKET

RECORDER CASE-SECURE
TO WALL

DOOR LOCK

STRIP
HEATER

1" CONDUIT FOR POWER
& TRANSMISSION LEADS

4" Steel Pipe

APPROVED FOR CONSTRUCTION

By *W. L. Anderson*

Date FEB 28 1972

S-103

2

PART NO.

P/N
REV.

S-103
DRAWING NO.

2
REV.

SHEET 1 OF 1

SCALE: NONE

DRAWN FV 4/23/71

CHECKED CWILSON 5-10-71

BADGER METER MFG. CO.

2700 & 2900 SERIES RECORDER

SIZE MODEL TYPE

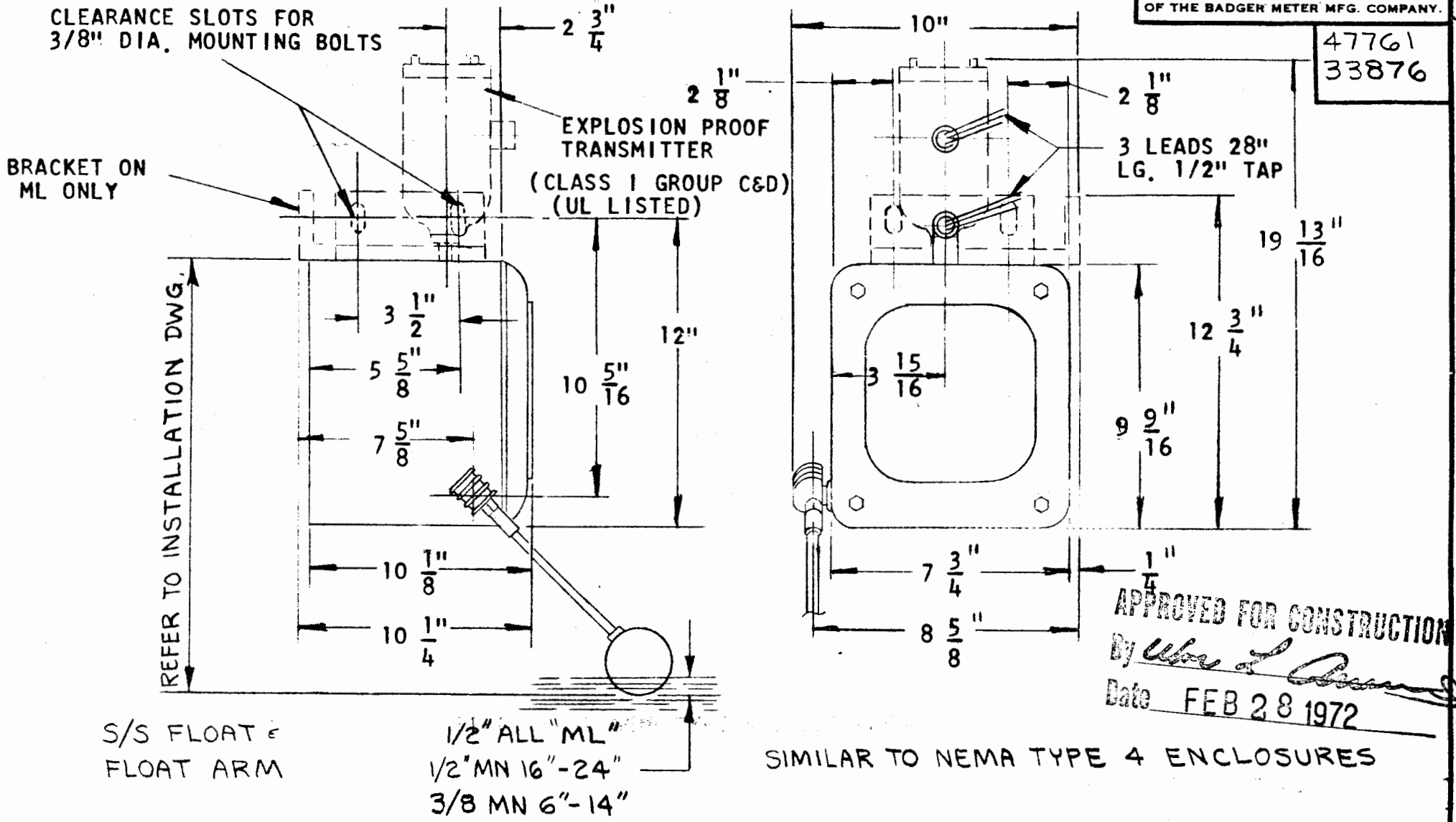
CASE, OUTDOOR - WALL MOUNTING

PART NAME

4" Pipe

2		FV	4-23-71
1		26H	12-1-70
NO	CHANGE	BY	DATE

MATERIAL



				BADGER METER MFG. CO.		S-200 DRAWING NO.		REV. 1	
				DIMENSIONAL DRAWING FOR MN & ML		RGH 12-12-67 DATE			
				STANDARD & EXPLOSION PROOF ASSEMBLIES		12-14-67 DATE			
				PATTERN NO.		APPROVED		DATE	
				REMARKS		NONE			
				MATERIAL CAST ALUM.		SCALE			
				BMMCO CODE NO.					
NO.	CHANGE	BY	DATE						
			4-9-70						

S-401

DRAWING NO.

REV.

2

UNLESS OTHERWISE SPECIFIED

Z-70M

45866

ALL DIMENSIONS ARE IN INCHES

ALL SURFACES MARKED ☒ FLAT WITHIN
 ALL SURFACES MARKED ☐ PARALLEL WITHIN
 ALL SURFACES MARKED ☐ PERPENDICULAR WITHIN
 ALL SURFACES MARKED ☒ STRAIGHT WITHIN

TOLERANCE ON DECIMAL DIMENSIONS :
 TOLERANCE ON FRACTIONAL DIMENSIONS :
 TOLERANCE ON ANGULAR DIMENSIONS :
 ALL DIA'S. MARKED ☒ CONCENTRIC WITHIN
 REMOVE ALL BURRS .005 MAX X 45°

T.I.R.

NOTES:

1. INSULATION RESISTANCE OF TRANSMISSION LINES TO GROUND MUST BE AT LEAST 5 MEGOHMS AT 500 V.
2. MAXIMUM RESISTANCE OF TRANSMISSION WIRES MUST NOT EXCEED 40 OHMS PER LOAD.
3. USE THE FOLLOWING TRANSMISSION CABLES OR THEIR EQUALS:
 FOR DISTANCES UP TO 1200 FT. - GE#58196 #18 GAGE 3 CONDUCTOR SHIELDED CABLE.
 FOR DISTANCES UP TO 3000 FT. - GE#SI58002 #14 GAGE 3 CONDUCTOR CABLE IN 1/2" DIAMETER FLEXIBLE OR RIGID CONDUIT.
 FOR DISTANCES UP TO 5000 FT. - GE#SI58002 #12 GAGE 3 CONDUCTOR IN 1/2" DIAMETER FLEXIBLE OR RIGID CONDUIT.
 GROUND SHIELD OR CONDUIT TO TRANSMITTER & METER CASES.
4. WHEN EXPOSED TO LIGHTNING HAZARDS, INSTALL PROTECTIVE DEVICES. ASK FACTORY FOR DRAWING S-407
5. EXPLOSION PROOF WIRING REQ'D. FOR EXP. PROOF TRANSMITTER.

18" LEADS SEALED IN 1/2" PIPE *

NIPPLE FOR CONDUIT.

50 FT. LEADS CAN BE FURNISHED
AT ADDITIONAL COST.

EXPLOSION PROOF
TRANSMITTER
(IF SPECIFIED)

~~WATERPROOF
TRANSMITTER~~

FLOW

* ELECTRICAL CONTRACTOR MUST USE
WEATHERPROOF FITTING AND WATER-
PROOF SPLICES OR THE PENN/MEASURE-
RITE WARRANTY IS VOIDED.

RECORDER

FUSE & SWITCH
ACCESSIBLE IN-
SIDE METER CASE

7/8" DIA.
KNOCKOUTS IN
CASE FOR CON-
DUIT.

120 VOLT 60
CYCLE, SUPPLY
MUST BE GROUNDED

6. POWER LINES SHOULD NOT BE INCLUDED IN THE SAME CONDUIT AS TRANSMISSION LINES.

NOTE: FOR DIMS. OF ML & MN ASSEMS. SEE DRG. S-200

PENN MEASURE-RITE DIVISION
Badger Meter Mfg. Co.

S-401

DRAWING NO.

REV.

2

SIZE WIRING DIAGRAM ML, MN TRANSMITTERS
PART NAME

PATTERN NO. LAYOUT NO. INSTALLATION DWG.

S.O. NO. MATERIAL

FINISH HEAT TREAT

TJS 5/29/67
DRAWN

CHECKED

APPROVED

SCALE

NO. CHANGE BY DATE

ADDED 6 SS 8-18-71
4-9-70

APPROVED FOR CONSTRUCTION

FEB 28 1972

PA. DEPARTMENT OF REVENUE
TREASURER

FEB 19 1963

HARRISBURG